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CONSERVATION PLAN FOR

COLORADO RIVER CUTTHROAT TROUT

LITTLE SNAKE RIVER DRAINAGE
SOUTHEASTERN WYOMING

"To protect and reestablish genetically pure populations of Colorado River cutthroat trout in the Little Snake River drainage ..."

AN INTERAGENCY EFFORT INCLUDING:

Medicine Bow National Forest
Wyoming Game & Fish Department
Great Divide Resource Area, BLM

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CONSERVATION PLAN FOR COLORADO RIVER CUTTHROAT TROUT (*Oncorhynchus clarki pleuriticus*) FOR THE LITTLE SNAKE RIVER DRAINAGE, IN SOUTHEASTERN WYOMING

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PREFACE

This conservation and management plan is being developed by the USDA Forest Service (FS), Wyoming Game and Fish Department (WGFD) and the USDI Bureau of Land Management (BLM) to assist in protection and enhancement of Colorado River cutthroat trout populations in the Little Snake River drainage in Wyoming. This plan is a follow-up effort to a 1987 statewide management plan developed for Colorado River cutthroat trout by the WGFD in cooperation with the FS and BLM and subsequent evaluations of cutthroat and its habitat and potential habitat in the Little Snake River drainage.

This conservation and management plan is in conformance with Medicine Bow National Forest Management Plan (U.S. Department of Agriculture, 1985) and the BLM Great Divide Resource Management Plan (U.S. Department of Interior, 1990).

The FS and BLM will ensure that the requirements of their respective planning systems and the National Environmental Policy Act (NEPA) are fulfilled. This will include public review and comment, interdisciplinary review, and identification and analysis of environmental effects of each of the actions described in this plan. During this process alternatives may be developed and considered.

This conservation and management plan is being developed under the authority of Wyoming Statute 23-1-103, the Federal Land Management Policy Act of 1976, the Sikes Act, the Endangered Species Act, as amended, and other federal laws, regulations, executive orders and policies.

EXECUTIVE SUMMARY

The Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) historically occupied portions of the Colorado River drainage in Wyoming, Colorado, Utah, Arizona, and New Mexico. Today this subspecies only occupies a fraction of its historical range and is primarily located in small headwater streams. Colorado River cutthroat trout is a category 2 species (one that may be appropriate for listing as threatened or endangered) by the USDI Fish and Wildlife Service and is considered a sensitive species by Region 2 of the Forest Service. This conservation strategy is a continuation of efforts started in 1987 under a comprehensive management plan for Colorado River cutthroat trout in Wyoming.

Habitat Requirements and Life History Characteristics:

The seasonal habitat requirements of Colorado River cutthroat trout have rarely been studied. It is generally believed that the life history and ecology of the subspecies is similar to other cutthroat subspecies. Historically Colorado River cutthroat trout existed in a wide range of habitats but currently only occur in headwater streams. These streams are generally over 8000 ft above mean sea level and characterized by cold, clear, well oxygenated water with a pH ranging from 6 to 9. Optimal lacustrine habitat is characterized by clear, cold, deep lakes that are typically oligotrophic. The diet includes amphipods, other plankton, dipterans, and terrestrial hymenopterans. As fish become larger they will on occasion feed on small fish. Spawning takes place from late spring to early summer when peak spring flows begin to diminish. Fish reach sexual maturity between 2 and 4 years of age. Historically, the fish was believed to have reached large sizes in the Colorado River Basin. Today the fish is primarily located in small streams and seldom reaches a size over 12 inches.

Reasons for Concern:

Within the historic range of Colorado River cutthroat trout, factors such as habitat loss, heavy harvest and the introduction of non-native fish species have contributed to the decline of Colorado River cutthroat trout. Within the Little Snake River enclave for example, the total miles of stream containing allopatric populations of cutthroat have declined by 30 percent in the last 40 years. Specific reasons for concern are listed below:

1. Continuing invasion of brook trout into cutthroat trout waters on the Medicine Bow National Forest.

2. Land management activities including, logging, road construction, water diversions, livestock grazing and fire suppression continue to affect cutthroat trout habitat on state, federal and private lands.

3. The Colorado River cutthroat trout is extremely vulnerable to fishing pressure.

4. Populations of Colorado River cutthroat trout in most cases are isolated and highly fragmented. Fragmentation is a result of the isolation of populations in small headwater streams either through the past construction of man-made structures that impede cutthroat movement (e.g. Stage I and II of the Cheyenne Water Project) or the displacement of Colorado River cutthroat trout due to brook trout competition.

5. Colorado River cutthroat trout populations have been affected by sediment induced habitat changes from the numerous sediment spills that have occurred in the North Fork drainage as a result of the construction and operation of the Stage II pipeline.

6. The lack of a high purity brood stock for the Little Snake River enclave has precluded reintroduction attempts.

7. Previous efforts failed to address conservation of cutthroat trout at an ecosystem or watershed perspective.

MISSION STATEMENT: To protect and reestablish genetically pure populations of Colorado River cutthroat trout in the Little Snake River drainage for their social, ecological, recreational and aesthetic values.

Success Criteria:

To increase the miles of stream containing C purity (= good representatives of Colorado River cutthroat trout) or better.

To increase the miles of stream supporting a population of Colorado River cutthroat trout of at least 200 fish/mile or 25 pounds/mile.

To increase the miles of stream containing allopatric populations of Colorado River cutthroat trout.

To maintain or improve trout stream habitat quality in all watersheds in which Colorado River cutthroat currently resides or in those watersheds targeted for reintroduction efforts.

Goals: The desired conditions required in order to insure viable populations in the future.

1. Protect and maintain current populations and habitat of all "C" purity or better Colorado River cutthroat trout within the Little Snake River enclave, Wyoming.

2. Restore continuous habitat occupied by Colorado River cutthroat trout and other endemic species (i.e. mottled sculpin, flannelmouth sucker, and roundtail chub) in sufficient quantities to assure stable populations of these endemic species in the Little Snake River drainage.

3. Develop management plans for each of the major watersheds in which Colorado River cutthroat trout currently occur or those watersheds in which there is potential for population restoration. These plans will establish long-term management objectives for populations and habitat of endemic species.

4. Monitor populations and habitat to determine status and progress toward meeting goals and objectives established in 1994. Biological and habitat parameters to be monitored will be jointly agreed upon by representatives of the interagency working group.

5. Develop a genetically pure broodstock of Colorado River cutthroat trout as a source for population reestablishment and for population supplementation in streams open to angling.

6. Increase public awareness of the status and support, for management needs of Colorado River cutthroat trout.

7. Establish organizational arrangements to accomplish tasks and increase communication.

Total Cost of Management Efforts: Total management costs from all involved agencies are estimated at $708,700.

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Appendix Background information on Colorado River cutthroat trout in the Little Snake River enclave, Wyoming.

PART I - INTRODUCTION

PURPOSE AND NEED

The Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) historically occupied portions of the Colorado River drainage of Wyoming, Colorado, Utah, Arizona and New Mexico. Many scientists believe that the Colorado River cutthroat trout currently occupies less than 1% of this historical range. Decline of Colorado River cutthroat trout has also occurred within the Little Snake River enclave over the past 40 years. In 1954 approximately 78 miles of streams within the Little Snake River enclave contained Colorado River cutthroat trout. In 1993, this number dropped to approximately 51 miles. This represents a 30% decline in the miles of stream containing Colorado River cutthroat trout in 40 years. Additional background information on the Colorado River cutthroat trout in the Little Snake River drainage is located in the Appendix.

Colorado River cutthroat trout is a category 2 species (one that may be appropriate for listing as threatened or endangered) by the USDI Fish and Wildlife Service (FWS) (1985) and is considered a sensitive species by Region 2 of the Forest Service. In 1987, Wyoming Game and Fish Department (WGFD) in cooperation with the Bureau of Land Management (BLM) and USDA Forest Service (FS) developed a comprehensive management plan for Colorado River cutthroat trout in Wyoming. This plan called for specific projects to be accomplished in the three target enclaves in Wyoming in the areas of range expansion, habitat protection and enhancement, and to increase sport fishing opportunities. The Medicine Bow National Forest (MBNF) signed a Memorandum of Understanding (MOU) with WGFD for implementation of the Little Snake River enclave portion of this plan in 1987. In 1990, an evaluation of the accomplishments within the Little Snake enclave was completed by Wyoming Game and Fish Department (Oberholtzer 1990). This report outlined major concerns that, if not addressed, were felt to have deleterious effects on cutthroat habitat and populations in the future.

In the fall of 1991, representatives of the Medicine Bow National Forest, Wyoming Game and Fish Department and Bureau of Land Management met to review the findings of the 1990 status report completed by Wyoming Game and Fish. This committee addressed the strengths and weakness of the 1987 Management Plan, its accomplishments, and provided recommendations on where and how to proceed in the future. Subsequent meetings were held to establish a framework and to identify additional issues (management concerns) that have developed since completion of the 1990 report.

This plan is the culmination of this interagency team effort. This Conservation Plan has a three-fold purpose: 1) protect all known cutthroat populations of "C" purity or higher; 2) reestablish genetically pure populations within Colorado River cutthroat trout

historic range with an emphasis on re-uniting isolated populations thereby increasing genetic exchange between stocks reducing potential loss of entire stocks through catastrophic events and; 3) Maintain, and where appropriate, improve stream health in cutthroat trout watersheds. The primary emphasis areas for this effort will be the West Branch and North Fork of the Little Snake River administered by the Medicine Bow National Forest and the headwaters of Muddy Creek which includes Littlefield and McKinney Creeks administered by the Great Divide Resource Management Area of the BLM (Figure 1). This plan provides specific direction for the Medicine Bow National Forest, Wyoming Game and Fish and Bureau of Land Management for the management of Colorado River cutthroat trout in the Little Snake River drainage.

REASONS FOR CONCERN

Within the historic range of Colorado River cutthroat trout, factors such as loss of habitat, over-harvest and introduction of non-native fishes have contributed to the reduction in number and distribution of this subspecies (Behnke 1992). These same factors have also led to the decline of cutthroat in the Little Snake enclave. Specific reasons for concern are listed below:

1. Continuing invasion of brook trout into cutthroat trout waters on the Medicine Bow National Forest.

2. Land management activities including, logging, road construction, water diversions, livestock grazing and fire suppression continue to affect cutthroat trout habitat on state, federal and private lands.

3. The Colorado River cutthroat trout is extremely vulnerable to fishing pressure.

4. Populations of Colorado River cutthroat trout in most cases are isolated and highly fragmented. Fragmentation is a result of the isolation of populations in small headwater streams either through the past construction of man-made structures that impede cutthroat movement (e.g. Stage I and II of the Cheyenne Water Project) or the displacement of Colorado River cutthroat trout presumably due to brook trout competition.

5. Colorado River cutthroat trout populations have been affected by sediment induced habitat changes from the

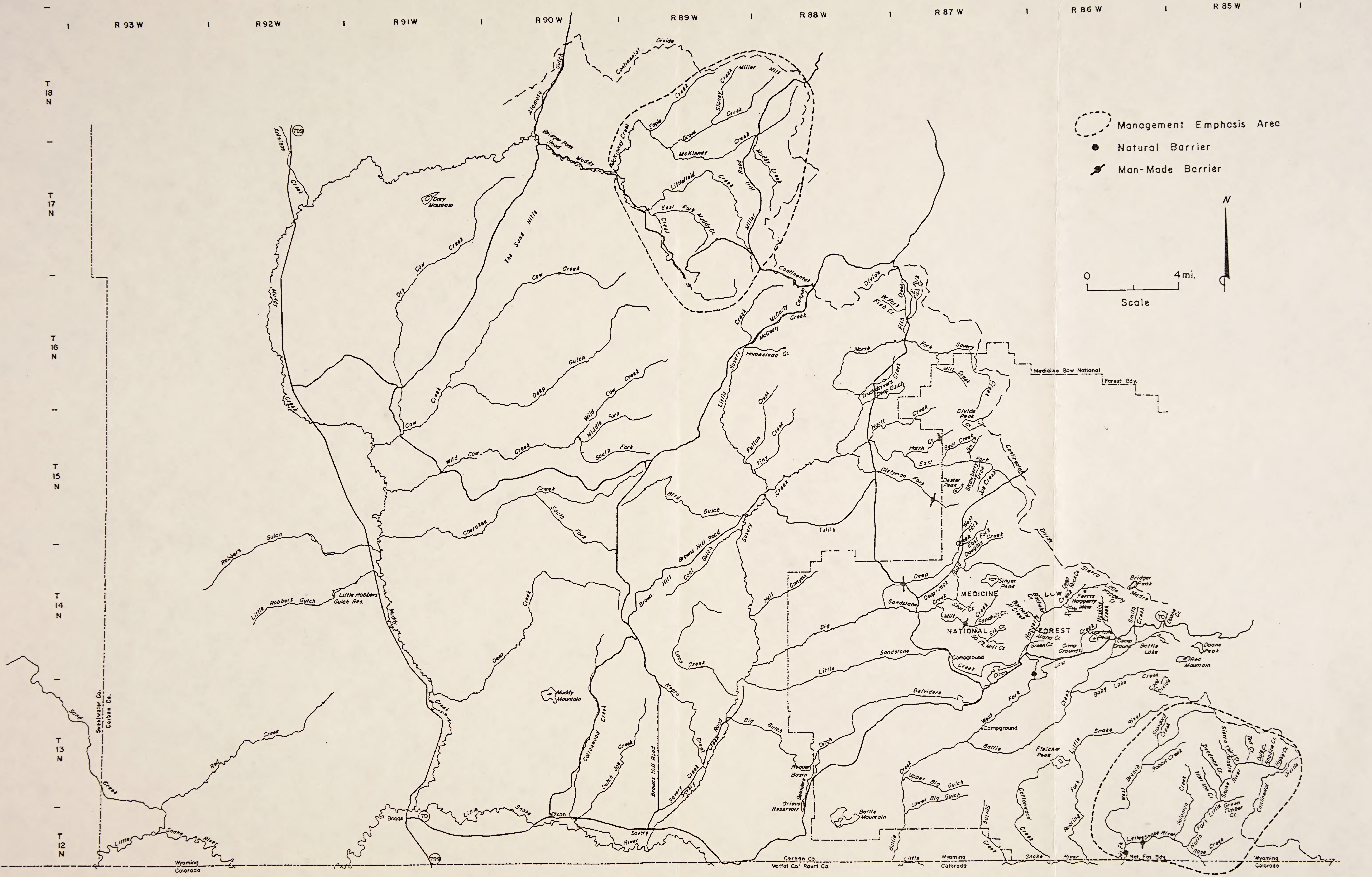
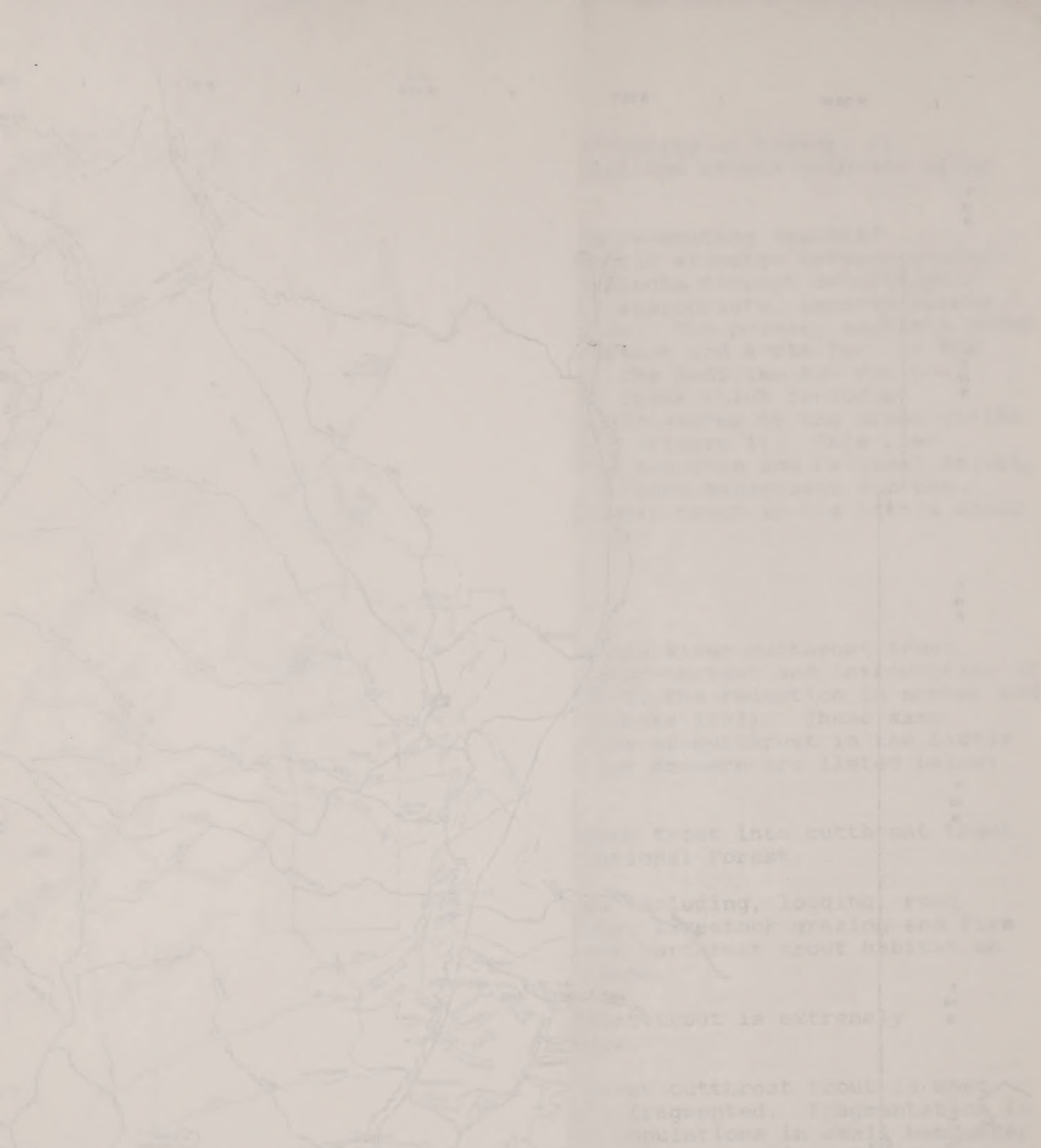


FIGURE 1. LITTLE SNAKE RIVER DRAINAGE, WYOMING



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numerous sediment spills that have occurred in the North Fork drainage as a result of the construction and operation of the Stage II pipeline. Long-term sediment loading from continued mishaps with the Stage I & II pipelines and chronic inputs of sediment from road stream crossings are predicted to cause on-going habitat degradation within the drainage.

6. The lack of a high purity brood stock for the Little Snake River enclave has precluded reintroduction attempts.

7. Previous efforts failed to address conservation of cutthroat trout at an ecosystem or watershed perspective. Maintenance of biological integrity requires a focus on ecosystem processes and communities rather than individual populations or species. Future management of cutthroat must be considered with an ecosystem perspective. Conservation strategies must be planned and conducted on a watershed basis free largely of jurisdictional boundaries.

PART II - CONSERVATION AND ENHANCEMENT MEASURES

RESPONSIBILITIES

The success of this conservation plan in bringing about the protection, conservation and restoration of cutthroat will require cooperation and joint efforts of the general public, state and federal agencies, and users of state and federal lands. Implementation is primarily the responsibility of the Wyoming Game and Fish Department, Bureau of Land Management and the Forest Service. Responsiblities are outlined below:

1. The State of Wyoming, through the Wyoming Game and Fish Department, provides for the protection, preservation and propagation of fish within the State. Through legal authority, the Department enforces the laws pertaining to the management of the fishery resources.

2. The Forest Service is required by the Federal Land Policy and Management Act (FLPMA) to practice multiple-use land management. Agency policy and Federal Acts further define direction associated with indigenous species. Forest Service Policy also provides direction for the management of Sensitive species. On March 19, 1993, Region 2 (Rocky Mountain Region) of the Forest Service completed a sensitive species list which requires the Forest Service to complete Biological Evaluations for all federal actions which could affect these species. Colorado River cutthroat trout is on

this list. The Medicine Bow National Forest Plan also lists cutthroat as a management-indicator species and requires that the habitat be managed to maintain current populations and protect species purity.

3. The Bureau of Land Management is required by FLPMA to practice multiple-use management. FLPMA, other Federal Acts, and agency regulations, and policy also define the Bureau's responsibility for fish and wildlife habitat inventory and management on BLM-administered lands. It is BLM policy to protect, conserve, and manage federal and state sensitive species to ensure their continued existence, to prevent the destruction or adverse modification of their habitats. The Great Divide Resource Management Plan objectives for fisheries identify the need to provide habitat quality to support a natural diversity of non-game and game fish, sensitive, threatened, and endangered species, as well as to assist in meeting goals of recovery plans.

MISSION STATEMENT: To protect and reestablish genetically pure populations of Colorado River cutthroat trout in the Little Snake River drainage for their social, ecological, recreational and aesthetic values.

GOALS: The desired conditions required in order to insure viable populations in the future.

1. Protect and maintain current populations and habitat of all "C" purity or better Colorado River cutthroat trout within the Little Snake River enclave, Wyoming.

2. Restore continuous habitat occupied by Colorado River cutthroat trout and other endemic species (i.e. mottled sculpin, flannelmouth sucker, and roundtail chub) in sufficient quantities to assure stable populations of these endemic species within the Little Snake River drainage.

3. Develop management plans for each of the major watersheds in which Colorado River cutthroat trout currently occur or those watersheds in which there is potential for population restoration. These plans will establish long-term management objectives for populations and habitat of endemic species.

4. Monitor populations and habitat to determine status and progress toward meeting goals and objectives established in 1994. Biological and habitat parameters to be monitored will be jointly agreed upon by representatives of the interagency working group.

5. Develop a genetically pure broodstock of Colorado River cutthroat trout as a source for population reestablishment and for population supplementation in streams open to angling.

6. Increase public awareness of the status, and support for management needs, of Colorado River cutthroat trout.

7. Establish organizational arrangements to accomplish tasks and increase communication.

SUCCESS CRITERIA:

To increase the miles of stream containing C purity (= good representatives of Colorado River cutthroat trout) or better.

To increase the miles of stream supporting a population of Colorado River cutthroat trout of at least 200 fish/mile or 25 pounds/mile.

To increase the miles of stream containing allopatric populations of Colorado River cutthroat trout.

To maintain or improve stream habitat quality in all watersheds in which Colorado River cutthroat currently resides or in those watersheds targeted for reintroduction efforts.

OUTLINE OF CONSERVATION ACTIONS TO BE TAKEN TO ACCOMPLISH SPECIFIC GOALS:

GOAL 1. Protect and maintain current populations and habitat of all "C" purity or better Colorado River cutthroat trout within the Little Snake River enclave, Wyoming.

Preventing further decline of Colorado River cutthroat trout is a primary conservation objective. That is, protection and maintenance of current populations and habitat presents the foundation for conservation of this subspecies. Future conservation activities will be irrevocably jeopardized unless the existing genetic preserves within the Little Snake River enclave are protected and maintained.

Objective A. By 1994, protect a minimum of 2 miles of an allopatric cutthroat population in the headwaters of the Roaring Fork at Standard Park from invasion by brook trout. The purity of this population is rated as "A"; the physical isolation of this population has precluded it from genetic contamination.

Objective B. By 1997, develop a plan to eliminate copper leaching into Haggerty Creek within the Battle Creek drainage. This will be coordinated with Environmental Protection Agency (EPA), the mine owner (presently Mr. Terry Hankins), Wyoming DEQ, and other state and federal agencies. The Medicine Bow National Forest will pursue all available avenues to fulfill this objective.

Objective C. Beginning in 1994 and continuing thereafter, all land management activities conducted by the FS or BLM which could impact cutthroat and require an EA or EIS will have a fisheries biologist involved in the development and assessment of the proposed project.

Objective D. On an on-going basis, look for opportunities to acquire and/or maintain instream flows. The Wyoming Game and Fish Department is interested in working with the Forest Service and Bureau of Land Management to identify streams where instream water rights would be appropriated for the protection of critically important fisheries.

Objective E. Implement fish stocking and harvest regulations that will assure cutthroat population protection but continue to provide angling opportunities in the drainage.

GOAL 2. Restore continuous habitat previously occupied by Colorado River cutthroat trout and other endemic species (i.e. mottled sculpin, flannelmouth suckers, and roundtail chub) in sufficient quantities to assure stable populations of these endemic species within the Little Snake River drainage. This habitat must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of the species of concern.

The restoration of Colorado River cutthroat trout and other endemic fishes within historically occupied habitat will be accomplished through the improvement of aquatic habitat and the reestablishment of endemic species within targeted watersheds. Habitat improvement will center on correction of current land management practices that have lead to degraded aquatic habitats making them inhabitable by cutthroat. Population restoration will focus on the re-establishment of endemic fish communities by first removing exotics (e.g. brook trout) then re-introducing the endemic fishes either through transplanting of fish from stable populations and/or through the establishment of a broodstock from which genetically pure fish could be obtained (see Goal 5).

Objective A. By 1995, increase stream miles containing high purity Colorado River cutthroat trout by 200 percent (4.5 miles) within Deep Creek (Big Sandstone Watershed).

Objective B. By 1996, design and construct habitat improvement structures in upper Muddy Creek to accelerate habitat restoration in preparation for reestablishment and maintenance of cutthroat populations of 250/mile or 100 lb/acre.

Objective C. By 1998, design and construct habitat improvement structures in Littlefield Creek to accelerate habitat restoration in preparation for cutthroat reestablishment and maintenance of cutthroat populations of 800 fish/mile or 200 lb/acre.

Objective D. By 1998, reintroduce high purity cutthroat within the Muddy Creek drainage, specifically Littlefield Creek (10 miles) and the upper end of Muddy Creek (14 miles) primarily within the Grizzly Habitat Management Area. A management plan has been completed by the Bureau of Land Management for these watersheds. Completion of this objective is contingent upon the development of a high purity broodstock (See Goal 5).

Objective E. By 1998, establish stable populations of flannelmouth sucker and roundtail chub in Muddy Creek and Littlefield Creek within the Grizzly Habitat Management Area.

Objective F. By 1998, increase the miles of stream containing high purity cutthroat by an additional 20 percent (11.4 miles) within the North Fork and West Branch of the Little Snake River. During this process, every effort will be made to protect mottled sculpin populations within the targeted streams.

Objective G. Continue to participate in the Upper Muddy Creek Coordinated Resource Management (CRM) plan to insure coordination/cooperative management to improve fisheries habitat and provide the reestablishment of Colorado River cutthroat trout in the Muddy, Littlefield, and McKinney Creek drainages. An additional 20 miles of stream (including tributaries) could be made available for Colorado River cutthroat trout reestablishment in McKinney Creek.

Objective H. By 1998, determine the need for fish passage structures on streams affected by stage I and II of the Cheyenne Water project. This objective will be tied to monitoring efforts described in goal 4 and watershed inventories to be conducted under goal 3.

GOAL 3. Develop management plans for each of the major watersheds in which Colorado River cutthroat trout currently occur or those watersheds in which there is potential for population restoration. These plans will establish long-term management objectives for populations and habitat of endemic species.

There is a need to describe habitats on a watershed scale and to develop watershed plans on how those habitats should be managed. These plans will include a description of the range of conditions in a particular watershed, establish a set of habitat and population goals and objectives, and provide recommendations concerning watershed and stream improvement and restoration. These sub-drainage plans will be flexible and will be updated as more information becomes available.

Development of watershed management plans will follow an environmental assessment procedure to ensure watershed management to preserve and/or enhance Colorado River cutthroat trout is compatible with other land use activities. One such plan has been completed for the Grizzly Habitat Management Area administered by the BLM. As sub-drainage plans are developed, the scope of this type of management planning will be better defined. Suggested Management watersheds include: Savery Creek drainage, Roaring Fork of the Little Snake River drainage, North Fork and West Branch of the Little Snake drainage and the Upper Muddy Creek CRM.

Objective A. By 1995, establish watershed management objectives for the upper Muddy Creek watershed that will assure long-term sustainability of the aquatic ecosystem.

Objective B. By 1996, establish habitat management objectives for the North Fork and West Branch watersheds that will assure long-term sustainability of the aquatic ecosystem.

Objective C. By 1998, establish habitat management objectives for the Roaring Fork watershed that will assure long-term sustainability of the aquatic ecosystem.

Objective D. By 1999, establish management objectives for the Savery Creek watershed that will assure long-term sustainability of the aquatic ecosystem.

GOAL 4. Monitor populations and habitat to determine status and progress toward meeting goals and objectives established in 1994. Biological and habitat parameters to be monitored will be jointly agreed upon by representatives of the interagency working group. The following are monitoring procedures for the cutthroat effort.

I. Trends - Habitat and population trends within the enclave will need to be determined (See Goal 3). Historic data will be examined within watershed currently occupied by cutthroat to determine specific changes in both habitat and populations. Trend data will be reported on a watershed basis and will be used to develop specific habitat and population objectives for those watersheds.

II. Reference - It will be important to establish reference monitoring sites within geographically and ecologically similar areas. These sites will reflect low to minimal disturbance from land management activities and should provide background information on the temporal and spatial changes associated with natural systems. Reference monitoring will require a long-term commitment from management to determine the extent of natural variability in habitat and populations. Protocols developed for reference monitoring should be similar to those outlined for trend monitoring.

III. Implementation monitoring - Implementation monitoring will be used to answer the question "were the prescribed activities for an objective implemented correctly on the ground?" This type of monitoring will include structural habitat improvements and mitigation requirements for land management activities.

IV. Effectiveness monitoring will be used to determine if an objective was achieved for a specific activity. An example of such monitoring is whether or not brook trout were eliminated from a stream following a chemical restoration project. In this example electrofishing could be used to determine the water to be fish free prior to reintroduction of cutthroat.

V. Validation monitoring - validation monitoring will be the underpinnings for all the objectives described in this plan. Validation monitoring is essential to assess the effectiveness of the our current goals and objectives. This type of monitoring will be heavily reliant on research to determine new information concerning life history and habitat requirements of the subspecies. The working group will need to examine up-to-date information annually to determine whether it is appropriate to adapt goals and objectives with new information.

Objective A. By summer 1994 establish monitoring protocol and parameters to evaluate plan criteria. This protocol will use both biological and physical components agreed upon by the interagency working group.

Objective B. In 1994, establish reference conditions for habitat and fish populations for ecologically similar areas within the enclave. These same areas will be reevaluated in 1999 to determine adequacy of the conservation efforts presented in this plan.

Objective C. Annually, conduct monitoring to assess the effects of land management activities on cutthroat populations and habitat. Parameters used will be based upon the type and intensity of management activities, designated or existing water uses, the environmental setting, and the monitoring objectives and constraints.

Objective D. In 1994, the Medicine Bow National Forest will review and where appropriate, modify monitoring and administrative procedures for Stage II of the Cheyenne Water project.

GOAL 5. Develop a genetically pure broodstock of Colorado River cutthroat trout as a source for population reestablishment and for population supplementation in streams open to angling.

Efforts to develop a genetically pure broodstock began in 1986 when approximately 70 fish were collected from the Little Snake River drainage. After disease analyses came back negative, the eggs were transferred to the Saratoga National Fish Hatchery in Saratoga. Hatching success was good, but extensive mortality occurred when the fry refused to feed properly. In 1987, eggs were again collected from Green Timber Creek and East Fork of the Little Snake and transferred to the National Fish Hatchery in Saratoga. Again these fish were lost due to power failure that caused a shutdown in the water supply system in the isolation facility.

In 1988 a total of 60 fish were collected from what was thought to be "A" purity streams from which approximately 1000 eggs were collected and again taken to the fish hatchery in Saratoga, Wyoming. The culturing of these eggs were successful with approximately 400 fish produced in 1991. A sample of these fish were sent to the Wild Trout and Salmon Genetics Lab in Missoula, Montana and were found to be hybridized with Yellowstone cutthroat trout and thought to be marginally suitable for use as a broodstock. However the concern about the purity of these fish soon vanished when, in 1992, the Saratoga Hatchery accidently exposed the fish to chlorine resulting in 100% mortality.

The history associated with attempts to develop a Colorado River cutthroat trout broodstock in the Little Snake River has been difficult at best. While it is believed there is a need to establish such a broodstock, alternatives such as transference of high purity fish from stable populations within the enclave to target streams will be utilized as much as possible. If such transfers do not provide sufficient numbers and purity of cutthroat to accomplish the goals of this conservation effort then a high purity broodstock may be the only course of action available. In either case, it will be necessary to sample each of the major populations within the enclave to determine their purity levels. A variety of techniques will be used to determine purity including electrophoretic analysis and/or mitochondrial DNA techniques. Protocol and procedures must also be established by WG&F hatchery personnel that will assure successful establishment of a broodstock. Protocols will include safe guards that assure successful rearing of fish prior to removal of wild stocks and the maintenance of genetic diversity.

Objective A. By 1996, develop a broodstock in the State hatchery system or other suitable rearing facility, sufficient for restocking rehabilitated streams (10,000-30,000 fingerlings at < 500 per pound). This broodstock will provide a backup source of high purity cutthroat if transfers of wild stocks proves to be ineffective.

Objective B. By 1997, identify genetic purity levels of all major stocks of Colorado River cutthroat trout from each major drainage in the enclave. Several streams will be sampled during 1994 and 1995 to facilitate accomplishment of Goal 5, objective A.

Objective C. By 1998, develop culture capabilities to provide 4,000 cutthroat catchables (4 fish/pound) per year for stocking in Little Snake River waters presently receiving catchable sized rainbow trout.

Objective D. By 1999, develop culture capabilities to provide private producers with sufficient numbers of cutthroat (eggs and juveniles) as needed for stocking of private waters within the Little Snake River drainage.

GOAL 6. Increase public awareness of the status and management needs of Colorado River cutthroat trout.

Public awareness and appreciation for Colorado River cutthroat trout's ecological and social values are important to both agency and public support for conservation. Efforts are needed to inform the public concerning the plight of Colorado River cutthroat trout and why aggressive management is essential. Support of the local angling groups, the general public, and other forest resource users will be needed to successfully implement reclamation efforts by state and federal agencies. A variety of programs and techniques can be used including video, newspaper, feature articles in Wyoming Wildlife magazine and through WGFD's Watchable Wildlife Program.

Objective A. On an on-going basis, prepare and disseminate printed material which will inform the public about the protection and enhancement of Colorado River cutthroat trout populations within the Little Snake River enclave.

Objective B. Conduct 2 public contacts annually to increase public awareness of cutthroat management through newspaper articles, radio, slide-tape programs, interpretive signs, aquatic education days, or other avenues deemed important.

Objective C. Beginning in 1994, bi-annually conduct open house meetings in the Towns of Saratoga, Rawlins, Laramie and Baggs, to discuss management rationale and results of various management operations.

GOAL 7. Establish organizational arrangements to accomplish tasks and increase communication.

Specific organizational arrangements are needed to effectively meet the diverse challenges facing the conservation of this subspecies. Even though this plan is specific to the Little Snake River enclave, Wyoming, there is a need to coordinate on a multi-state, multi-jurisdictional level to help develop and maintain support for cutthroat conservation efforts.

Objective A. In 1994, form a management team composed of representatives of Regions 2 and 4 of the Forest Service, Bureau of Land Management, Wyoming Game and Fish Department, and Colorado Division of Wildlife to coordinate conservation efforts.

Objective B. Maintain the Little Snake River enclave working group to facilitate plan implementation and funding.

Objective C. By 1994, establish a research review committee to identify research needs related to the management of Colorado River cutthroat trout. Research may include, but is not limited to, studies addressing population fragmentation, genetic isolation, small population size, habitat requirements and other limiting factors.

LITERATURE CITED

Oberholtzer, M. 1990. Current Status of Colorado River cutthroat trout in the Little Snake River Enclave. Wyoming Game and Fish Report 5090-28-8501. Cheyenne, Wyoming.

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United States Department of Interior, 1990. Bureau of Land Management Great Divide Resource Management Plan.

PART III - IMPLEMENTATION SCHEDULE

Costs outlined in the following implementation schedule are estimated annual costs for implementing each task. They are not meant to represent costs to a specific Agency or Group. However the basic principle of this plan is that protection and enhancement of Colorado River cutthroat trout in the Little Snake River enclave is a cooperative responsibility.

Definitions of Priorities

Priority 1 - An action that must be taken to prevent continued loss of Colorado River cutthroat trout habitat and populations which could potentially lead to proposed listing.

Priority 2 - An action that is necessary to fully accomplish stated goals of this plan.

Abbreviations Used in Implementation Schedule

BLM	Bureau of Land Management
FS	Forest Service (Medicine Bow National Forest)
WGFD	Wyoming Game and Fish Department
P	Priority - Ongoing task will be required over a long or undetermined period of time.

CONSERVATION PLAN IMPLEMENTATION SCHEDULE

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	1.A1	Conduct NEPA on fish barrier in Roaring Fork.	FS	$3,000					
1	1.A2	Design and construct fish barrier in Roaring Fork	FS, WGFD	$5,000					
1	1.A3	Eradicate brook trout from Roaring Fork down to constructed barrier	WGFD FS		$4,000				
1	1.B1	On an ongoing basis coordinate with Wy Department of Environmental Quality to eliminate copper leaching from the Ferris Haggerty Mine.	FS	$500	$500	$500	$500	$500	$500
1	1.C1	Annually inspect fish barriers and conduct necessary maintenance work.	FS	$1,000	$1,000	$1,000	$1,000	$1000	
1	1.D1	Annually identify those land management activities which pose potential harm to cutthroat habitat and populations.	FS	$1,000	$1,000	$1,000	$1,000	$1000	
1	1.D2	Collect necessary data and conduct a biological evaluation on land management activities.	FS, BLM	$20,000	$20,000	$20,000	$20,000	$20,000	
1	1.E1	Annually review Special Use Permits that affect streamflows on the forest.	FS	$500	$500	$500	$500	$500	$500
1	1.E2	Discuss instream flow issues annually at the BLM/FS/WYG&F coordination meetings.	FS WGFD	ongoing	ongoing	ongoing	ongoing	ongoing	ongoing

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	1.F1	Semiannually review stocking and harvest regulations affecting cutthroat fisheries.	WGFD		$500		$500		
1	1.F2	Identify important waters containing cutthroat and prohibit stocking that could jeopardize these waters.	WGFD	$1,000	$1,000				
1	1.F3	Liberalize creel limits for brook trout where there are established allopatric populations.	WGFD		$2,000				
1	1.F4	Begin stocking high purity cutthroat in waters containing allopatric populations of brook trout and in waters presently stocked with rainbow.	WGFD					$3,000	
1	2.A1	Electrofish Deep Creek to determine effectiveness of eradication efforts conducted in 1993.	WGFD	$1,000	$1,000	$1,000	$1,000	$1,000	
1	2.A2	Transplant cutthroat from a nearby stable population into Deep Creek.	WGFD	$2,000					
1	2.A3	Electrofish Mill Creek to determine effectiveness of brook trout eradication efforts conducted in 1986.	WGFD	$2,000					
1	2.B1	Design habitat improvements in Muddy Creek.	BLM	$3000					
1	2.B2	Complete NEPA for Muddy Creek Projects.	WGFD		$2,000				
1	2.B3	Construct habitat improvements in Muddy Creek (State lands)	WGFD			$60,000			

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	2.B4	Protect spring sources and channels in the headwaters of Muddy Creek by fencing, salt placement, relocation of lambing pastures and shifting grazing pressure from critical areas.	BLM	$2,000	$4,000				
1	2.C1	Design a series of low profile over-pour structures and spawning gravel enhancement structures along Littlefield Creek.	BLM WGFD			$4,000			
1	2.C2	Complete NEPA for improvements.	WGFD				$3,000		
1	2.C3	Construct habitat improvements in Littlefield Creek.	WGFD					$15,000	
1	2.D1	Complete NEPA for reintroduction efforts in Muddy Creek and Littlefield Creeks.	BLM	$2,000	$2,000				
1	2.D2	Design and construct fish barrier below the confluence of Littlefield and Muddy Creeks at R89W T17N Sec. 18.	BLM		$24,000				
1	2.D3	Eradicate brook trout from Littlefield and Muddy Creeks. Rehabilitation will occur from the headwaters downstream to the proposed fish barrier.	BLM WGFD			$20,000	$20,000		
1	2.D4	Stock high purity cutthroat in Muddy Creek and Littlefield Creek drainages. These fish may be obtained from hatcher stock or through transplantation from stable populations on the Medicine Bow National Forest.	WGFD						$3,000

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	2.E1	Collect Flannelmouth suckers and roundtail chub from stable populations and stock in Muddy and Littlefield Creeks.	WGFD					$4,000	
1	2.F1	Design and conduct NEPA for a fish barrier off irrigation ditch at T12N R86W Sec. 10.	WGFD FS		$4,000				
1	2.F2	Construct barrier at T12N R86W Sec. 10	FS			$5,000			
1	2.F3	Conduct NEPA for the eradication of brook trout in West Branch and tributaries.	FS		$4,000				
1	2.F4	Eradicate brook trout from West Branch, North Fork and tributaries down to the natural barrier occurring at T12N R86W Sec. 14.	WGFD FS			$30,000			
1	2.F5	Re-treat West Branch, North Fork and tributaries	WGFD FS				$20,000		
1	2.F6	Electrofish West Branch, North Fork and tribuaries to determine success of eradication efforts. Following treatment introduce high purity cutthroat.	WGFD FS					$5,000	
1	2.G1	Begin Coordinated Resource Management (CRM) plans with involved interests to improve conditions in McKinney Creek watershed.	BLM	$2,000					

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	2.G2	Eradicate brook trout from McKinney Creek drainage. Following treatment introduce high purity cutthroat.	WGFD BLM						$40,000
1	2.H1	Conduct habitat assessments in all streams isolated by the stage I and II pipeline from the main watershed to determine important spawning areas.	FS WGFD		$2,000				
1	2.H2	Propose, if needed, remedial action to facilitate fish passage into historic spawning areas.	FS WGFD					$1,000	
1	2.H3	Coordinate with the Rocky Mountain Forest and Range Experimental Station on on-going research to determine fish movement patterns and habitat use by cutthroat in the North Fork of the Little Snake River drainage.	FS WGFD	$200	$200	$200	$200	$200	$200
1	3.A1	Complete CRM process on upper Muddy Creek watershed.	BLM		$10,000				
1	3.A2	Interagency team will review data from the Muddy Creek drainage and establish for management of the watershed.	BLM WGFD				$2,000		
1	3.B1	Complete riparian inventory using level I of the Integrated Resource Inventories (IRI) Common Water Unit criteria for all cutthroat watersheds on the forest.	FS	$1,000					

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	3.B2	Complete levels II, III, and IV of IRI. Modify parameters accordingly to better reflect actual habitat requirements of the fish.	FS		$6,000	$6,000			
1	3.B3	Interagency team will review data from the two drainages and establish habitat objectives for the North Fork and West Branch drainage.	FS WGFD				$3,000		
1	3.C1	Complete levels II, III and IV of IRI in Roaring Fork. Modify parameters accordingly to better reflect actual habitat requirements of the fish.	FS		$2,000	$6,000	$6,000		
1	3.C2	Interagency team will review data from the two drainages and establish objectives for the Roaring Fork watershed.	FS WGFD				$2,000		
1	4.A1	The interagency team will review current information concerning life history and habitat use of Colorado River cutthroat trout.	WGFD FS BLM	$2,000					
1	4.A2	Compile a document describing protocol to monitor long-term trends of cutthroat populations and habitat. The document will also discuss implementation monitoring, effectiveness monitoring and validation monitoring.	FS WGFD	$2,000					

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	4.B1	Using the protocol established in objective 4.A establish reference reaches in all drainage containing cutthroat. Both habitat and fish populations will be evaluated. Every attempt will be made to utilize historic sampling sites established by the National Forest or Wyoming Game and Fish Department so comparisons can be made to previous conservation efforts.	FS WGFD		$20,000				
1	4.B2	Sample all reference reaches established in 1994. Wyoming Game and Fish in cooperation with FS and BLM will prepare a report discussing the findings of the monitoring effort and provide recommendations on future management needs.	WGFD FS BLM						$20,000
1	4.C1	Annually conduct monitoring of land use activities within watersheds containing cutthroat.	FS BLM	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000
1	4.C2	Annually complete monitoring reports. In most cases these reports will be a component of the Forest Plan or Resource Area Management Plan monitoring reports.	FS BLM	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
1	4.C3	Based on monitoring results, make necessary changes to implementation schedules, standards and guidelines, etc. to assure cutthroat habitats are not being adversely affected.	FS BLM	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	5.C1	Review Stage II EIS and judgement from National Wildlife Federation lawsuit to determine compliance of the project with these documents.	FS	$1,000					
1	5.C2	Develop a monitoring and Special Use compliance plan for the Stage I and II of the Cheyenne Water Project. This will be done in cooperation with the City of Cheyenne.	FS	$2,000					
1	5.A1	Collect fish in Battle Creek drainage for genetic analysis (electrophoretic analysis).	WGFD FS	$5,000					
1	5.A2	Collect fish in Savery Creek drainage for genetic analysis.	WGFD FS		$5,000				
1	5.B1	In 1994, identify alternative brood pond sites within the Little Snake River drainage. Potential sites include: Battle Lake, new pond on Deadline Creek, existing ponds on Hatch Creek (Divide Peak Ranch), or isolated sections of stream.	WGFD FS	$3,000					
1	5.B2	If desired brood pond site is on FS or BLM lands, complete necessary NEPA.	FS		$4,000				
1	5.B3	Design and construct brood pond.	WGFD FS		$40,000				

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	5.B4	WYG&F Culture Section will develop protocol necessary to insure genetic diversity, spawning, rearing and disease certification.	WGFD	$2,000					
1	5.B5	Transplant adult cutthroat as determined from culture protocol, from the North Fork of the Little Snake into brood pond.	WGFD			$4,000			
1	5.B6	Stock streams with cutthroat.	WGFD				$2,000	$2,000	$2,000
1	5.C1	WYG&F Hatchery Section will take the necessary steps to insure hatchery space for 4,000 adult cutthroats per year.	WGFD			$5,000	$10,000	$10,000	$10,000
2	5.D1	WYG&F Hatchery Section will take the necessary steps to insure that enough eggs are produced annually to support the private sector.	WGFD					$3,000	$10,000
1	6.A1	Prepare an information brochure discussing cutthroat management strategy within the enclave.	BLM FS WGFD	$4,000					
1	6.A2	Yearly complete a cutthroat accomplishment report to be shared with the public and partners.	BLM FS WGFD	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
2	6.B1	Write a newspaper article detailing cutthroat management strategies in the enclave.	WGFD FS BLM	$500					
2	6.B2	Write an article for Wyoming Wildlife magazine detailing cutthroat management strategies in the enclave.	WGFD FS BLM		$2,000				

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	6.B3	Each Agency cooperating in this conservation effort will complete at least one public contact each year for the duration of the plan.	WGFD FS BLM	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
1	6.C1	Hold public meetings in Saratoga, Rawlins, Baggs and Laramie.	WGFD	$2,000		$2,000		$2,000	
1	7.A1	Coordinate development of management team with completion of the Conservation Assessments sechuled for completion by the Forest Service in 1994. These assessments will help formulate Regional and National Forest Service management strategies concerning sensitive species like Colorado River cutthroat trout.	FS, et. al.	$1,000	$1,000				
1	7.A2	Prepare action items to be dealt with in the Rocky Mountain and Intermountain Area. Specific action items will be assigned to individual, teams or Agencies for action and response back to the group.	FS, et. al.		$3,000	$3,000			
1	7.B1	In January each year, hold coordination a coordination meeting between the Medicine Bow National Forest, Bureau of Land Management (Rawlins District) and Wyoming Game and Fish Department.	WGFD	$1,000	$1,000	$1,000	$1,000	$1,000	$1,000
1	7.B2	Prepare action items to be completed that year.	WGFD						

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
1	7.C1	Establish a advisory committee made up of managers and researchers. Possible candidates for the committee include: Scientists from the Rocky Mountain Experimental Station, University of Wyoming, Utah State University, The University of Montana and managers from the participating agencies. This effort will be tied to Habitat Conservation Assessments currently being completed by the Forest Service.	FS WGFD BLM	$1,000					
1	7.C2	Develop a priority list of research activities needed improve management of Colorado River cutthroat trout.	FS WGFD BLM		$2,000				
1	7.C3	Develop proposals for high priority research items and submit to the appropriate State, Federal or Private entities for their consideration.	FS WGFD BLM						
		TOTAL COST PER YEAR		$65,700	$176,700	$189,200	$102,700	$78,200	$96,200

P	Obj	Task	Agency	1994	1995	1996	1997	1998	1999
[illegible]	6.B1	Each Agency cooperating in this conservation effort will complete at least one public contact each year for the duration of the plan.	WGFD FS BLM	$1,000	$1,000	[illegible]	$1,000	$1,000	$1,000
1	6.C1	Hold public meetings in Saratoga, Rawlins, Baggs and Laramie.	WGFD	$2,000		$2,000		$2,000	
1	7.A1	Coordinate development of management team with completion of the Conservation Assessment including the consultation by the Forest Service to [illegible]	FS, et al.	$1,000	$1,000				

APPENDIX

BACKGROUND INFORMATION OF COLORADO RIVER CUTTHROAT TROUT IN THE LITTLE SNAKE RIVER ENCLAVE, WYOMING

TAXONOMY

The Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) is the only trout endemic to the Green River drainage of Wyoming. This subspecies was first described by Cope (1871) when he surveyed Wyoming fish and reptiles. Descriptions of scale counts, spotting, and coloration were added by Jordon (1891). Behnke and Zarn (1976) provided the first adequate description of the subspecies. These descriptions were based on morphological measures (variation in body morphology, spotting patterns, and meristic characteristics). Chromosome karyotyping, protein electrophoresis, and more recently, the use of mitochondrial DNA have been used to examine taxonomic relationships among cutthroat subspecies. Many authors have noted increased discrimination among populations with these techniques as compared to that provided by morphology (Williams and Shiozawa, 1989).

External meristic characteristics of the fish include large, round, black spots that are concentrated posteriorly and mostly along the lateral line. The spotting varies with location, with the fish in the Little Snake River Enclave having somewhat larger spots than fish in the Green River and the Blacks Fork Enclave (Binns 1977). Scales are small with 43 or more above the lateral line. Coloration is well developed, especially in spawning males, and includes a well developed jaw slash and ventral colors that are typically bright orange in Little Snake River enclave fish. Overall body color is bronze gold to silver with a distinct black margin on the adipose fin.

Table 1 provides a summary of all the streams within the enclave that contain *O. pleuriticus*. Twenty-nine streams have populations of *O. pleuriticus* that are considered to be good representatives of the subspecies based on meristic characteristics and/or electrophoretic analysis (Binns 1977, Behnke 1981, Behnke 1990, Leary et al. 1993). Good representatives have been defined by Binns (1977) as those stocks that have a purity rating of "C" or better. High purity populations ("A") are restricted to those areas of the enclave that are physically or chemically isolated. For example, Ted Creek and upper North Fork of the Little Snake have separate populations because the populations have been isolated by the Stage I Diversion Structure for the Cheyenne Water Project. "A" purity populations in the headwaters of Solomon Creek have also been isolated in the early 1980s by Stage II of the Cheyenne Water Project. A chemical barrier exists in Haggerty Creek because of a copper effluent from the old Ferris-Haggerty Mine.

Table 1. Colorado River cutthroat trout population characteristics for the Little Snake River drainage, Wyoming.

STREAM	STOCK PURITY	STATUS	DENSITY	REMARKS
Alisha Creek	A	2	C	
Bachelor Creek	A	2	S	
Beaver Creek	A	3	R	
Deadline Creek	___	3	S	
Deadman Creek	C	1	A	Some evidence of rainbow trout contamination.
Deep Creek	C			Evidence of rainbow trout contamination.
Deep Creek, East Branch	A	3	S	
Deep Creek, West Branch	___	3	S	
Dirtyman Creek	B	1	A	A few individuals exhibit rainbow trout characteristics.
Elk Creek	B	3	S	Some evidence of rainbow trout contamination.
Green Creek	A	2	C	
Green Timber Creek	B	2	C	Evidence of rainbow and/or yellowstone cutthroat trout contamination.
Haggerty Creek	___	2	S	No sampling has been conducted.
Harrison Creek	C	1	A	Evidence of rainbow and yellowstone cutthroat trout contamination.
Haskins Creek, West Branch	A	3	R	Purity rating is based on analysis of one fish.

Table 1. (cond't)

STREAM	STOCK PURITY	STATUS	DENSITY	REMARKS
Hatch Creek	B	2	C	Some evidence of rainbow trout contamination.
Hell Canyon Creek	B	2	S	Some evidence of rainbow trout contamination.
Mill Creek, (Right Branch)	___	3	S	No sampling has been conducted.
Mill Creek	B	1	C	Evidence of rainbow trout and Yellowstone cutthroat trout contamination.
Mill Creek, South Fork	___	3	S	No purity analysis conducted.
Rabbit Creek	A	3	S	
Roaring Fork	A	1	A	Electrophoretic analysis, conducted in 1993, found fish to be pure with a high level of genetic divergence.
Rose Creek	B	1	A	External characteristics only were examined.
Skull Creek	B	3	S	Evidence of rainbow trout and Yellowstone cutthroat contamination.

Table 1. (cond't)

STREAM	STOCK PURITY	STATUS	DENSITY	REMARKS
Little Snake River, North Fork	D-A	1	A	A purity gradient exists in the North Fork, with fish from the lower area near the fish barrier rating as a "D", and those upstream near the Stage I Diversion rating as a "B". Fish above the Stage I Diversion are considered "A" purity.
Solomon Creek	A	1	A	Electrophoretic analysis, conducted in 1993, determined these fish to be pure *O. c. pleuriticus*. This is an up-grade from the "B+" purity level using meristic analysis.
Standard Creek	C	2	C	Obvious contamination with rainbow trout.
Ted Creek	A	2	S	Electrophoretic analysis conducted in 1993 confirmed purity level.
Third Creek	C	2	S	Obvious contamination with rainbow trout.
West Branch (NFLS)	B	3	S	Some contamination with rainbow trout.

Table 1. (cond't)

Stock purity

Symbol	Meaning
A	Pure.
B	Essentially pure, with trace contamination.
C	Good representatives of *O. c. pleuriticus* stock with some contamination by other trout species.
D	Representative of *O. c. pleuriticus* stock, but meristic and/or external characters show definite signs of hybridization.

Population Status

Symbol	Meaning
1	Well established in present habitat. Population appears relatively stable under existing conditions.
2	Adequately established in present habitat, but populations may be unstable due to fluctuating habitat conditions.
3	Precarious. Low population levels either due to poor habitat conditions or the presence of brook trout.

Density

Symbol	Meaning
A	Abundant
C	Common (moderate population density)
S	Sparse (light population density)
R	Rare (infrequent occurrence)

High purity populations exist in Alisha Creek, Bachelor Creek, and Green Creek as a result of this chemical barrier.

POPULATION SIZE AND DISTRIBUTION

The historic range of the subspecies covered the headwaters of the Colorado River, Green River, and San Juan River drainages in Utah, Wyoming, Colorado, Arizonia, and New Mexico (Behnke and Zarn 1976). During the past 100 years, the subspecies has been adversely affected by hybridization and competition with introduced trout, as well as the development of land and water resources within the Green River Basin (Binns 1977). As a result, *O. c. pleuriticus* populations have been drastically reduced and they occupy a fraction of their historic range (Figure 1).

In Wyoming, four widely separated enclaves of *O. c. pleuriticus*, have been identified: (1) Westside tributaries (Green River enclave), (2) Blacks Fork, (3) North Fork Little Snake, and (4) Big Sandstone. The North Fork Little Snake and Big Sandstone enclaves are located in the Sierra Madre Mountains predominately on the Medicine Bow National Forest (Figure 1). These two enclaves have since been combined to form the Little Snake River enclave.

Within the Little Snake River enclave, all current populations are known to reside within or immediately adjacent to the Medicine Bow National Forest. Oberholtzer (1990) estimated the total number of *O. c. pleuriticus* in the enclave to be 24,340 fish based on electrofishing estimates. This represents a slight increase in the total number of fish believed to exist within the enclave as compared to 1986 estimates. Changes in fish number are believed to be a result of natural variability in populations and not a change in reproductive success or increased quality of stream habitats.

The North Fork of the Little Snake River represents the largest and least fragmented population of *O. c. pleuriticus* known to exist in Wyoming (Binns 1977). However, construction of Stage I and Stage II of the Cheyenne Water Project has isolated most headwater tributaries within the watershed. The remainder of the known populations on Forest Service lands are reproductively isolated and have limited population size. Isolation is usually either a result of a natural or manmade barrier downstream, below which allopatric populations of brook trout (*Salvelinus fontinalis*) exist.

Recent studies conducted on *O. c. pleuriticus* within the North Fork of the Little Snake watershed indicate that the fish are very transitory, in some instances moving kilometers within the drainage (Young pers. comm.). It therefore appears that two separate populations currently exist: those fish that are above the Stage I and II pipelines and those populations below. Both pipelines

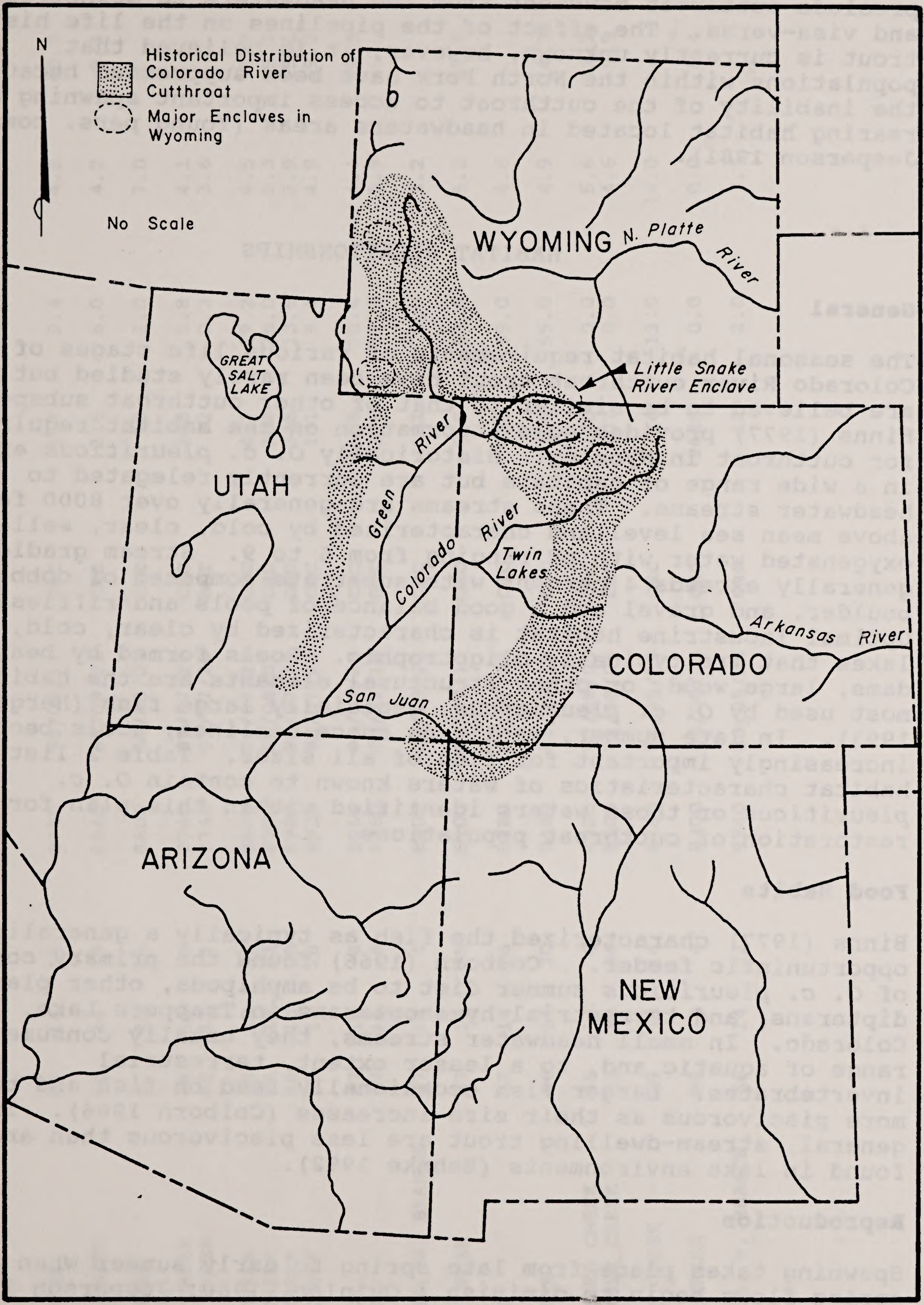

Figure 1. Historic distribution of Colorado River cutthroat trout.

preclude cutthroat movement from the headwaters to downstream areas and visa-versa. The effect of the pipelines on the life history of trout is currently unknown, however, it is believed that populations within the North Fork have been suppressed because of the inability of the cutthroat to access important spawning and rearing habitat located in headwaters areas (Young pers. comm.; Jesperson 1981).

HABITAT RELATIONSHIPS

General

The seasonal habitat requirements of various life stages of Colorado River cutthroat trout have been rarely studied but they are believed to be similar to that of other cutthroat subspecies. Binns (1977) provides some information on the habitat requirements for cutthroat in Wyoming. Historically *O. c. pleuriticus* existed in a wide range of habitats but are currently relegated to headwater streams. These streams are generally over 8000 feet above mean sea level and characterized by cold, clear, well oxygenated water with pH ranging from 6 to 9. Stream gradient generally exceeds 4 percent with substrate composed of cobble, boulder, and gravel and a good balance of pools and riffles. Optimal lacustrine habitat is characterized by clear, cold, deep lakes that are typically oligotrophic. Pools formed by beaver dams, large wood, or other structural elements are the habitat type most used by *O. c. pleuriticus*, especially large fish (Herger, 1993). In late summer, as living space declines, pools become increasingly important for fish of all sizes. Table 2 lists habitat characteristics of waters known to contain *O. c. pleuriticus* or those waters identified within this plan for restoration of cutthroat populations.

Food Habits

Binns (1977) characterized the fish as typically a generalists or opportunistic feeder. Colborn (1966) found the primary components of *O. c. pleuriticus* summer diet to be amphipods, other plankton, dipterans, and terrestrial hymenopterans in Trappers Lake, Colorado. In small headwater streams, they usually consume a wide range of aquatic and, to a lesser extent, terrestrial invertebrates. Larger fish occasionally feed on fish and become more piscivorous as their size increases (Colborn 1966). In general, stream-dwelling trout are less piscivorous than are trout found in lake environments (Behnke 1992).

Reproduction

Spawning takes place from late spring to early summer when peak spring flows begin to diminish (Quinlan, 1980; Jesperson 1981).

Table 2. Fish population and habitat characteristics for Colorado River cutthroat trout streams in the Little Snake River Enclave, Wyoming.

	STATION LOCATION								MEAN		
STREAM NAME	R	T	S	ELEVATION	DATE	SPECIES	NUMBER PER MILE	POUNDS PER/MILE	LENGTH INCHES	HQI SCORE	HABITAT UNITS
ALISHA CREEK	86	14	19	8785	90/09/17	CRC	157	9.4	4.8	40.7	44.6
BACHELOR CREEK	86	14	19	8840	83/09/23	CRC	216	6.0	4.2	9.4	14.7
BEAVER CREEK	87	15	23	8600	80/08/07	CRC	18	2.0	7.0		
DEADLINE CREEK	86	12	2	7740	87/07/29	CRC	288	5.8	4.1		
DEADLINE CREEK	86	12	2	7740	87/07/29	BKT	32	0.3	3.6		
DEADMAN CREEK	85	13	33	8600	90/07/25	CRC	417	29.2	4.5	11.7	16.9
DEADMAN CREEK	85	13	33	8700	86/08/07	CRC	304	26.0	5.3	19.1	23.9
DEADMAN CREEK	85	13	28	8900	90/07/25	CRC	338	13.5	3.9	15.8	20.8
DEADMAN CREEK	85	13	28	8922	90/07/23	CRC	181	9.1	4.9	19.2	24.0
DEEP CREEK	87	14	4	8360	90/07/16	CRC	1006	70.4	4.4	29.1	33.5
DEEP CREEK	87	14	4	8360	90/07/16	BKT	176	17.6	5.9		
DEEP CREEK, W. BRANCH	87	14	4	8400	83/09/23	CRC	192	8.0	3.2		
DIRTYMAN CREEK	87	15	29	8100	90/07/17	CRC	938	93.8	5.2	27.7	32.2
ELK CREEK	87	14	26	8280	85/07/28	CRC	625	59.0	4.8		
GREEN CREEK	86	14	30	8480	85/08/19	CRC	1129	55.0	4.9	14.7	19.8
GREEN TIMBER CREEK	85	12	4	8380	92/08/05	CRC	140	0.0	5.6	11.2	16.4
GREEN TIMBER CREEK	85	13	34	8500	92/08/05	CRC	307	0.0	4.6	9.9	15.2
BIG GULCH CREEK	89	13	14	6760	86/09/25	CRC	14	13.0	14.0		
HARRISON CREEK	85	12	4	8300	88/08/25	CRC	2688	0.0	0.0	8.4	13.7
HASKINS CR, W. BRANCH	86	14	22	9240	80/08/05	CRC	18	2.0	7.1		

Table 2. (cond't)

	STATION LOCATION						NUMBER	POUNDS	LENGTH	HQI	MEAN HABIT
STREAM NAME	R	T	S	ELEVATION	DATE	SPECIES	PER MILE	PER/MILE	INCHES	SCORE	UNITS
HASKINS CR, W. BRANCH	86	14	22	9240	80/08/05	BKT	598	54.0	5.9		
HATCH CREEK	87	15	8	8120	90/07/17	**CRC**	75	6.8	6.0		
HELL CANYON CREEK	88	14	18	7600	90/07/18	**CRC**	322	19.3	4.9	7.6	13.0
HELL CANYON CREEK	88	14	17	7780	90/07/18	**CRC**	823	32.9	4.6	8.8	14.1
L SNAKE RIVER, N. FORK	86	12	13	7400	90/08/08	**CRC**	122	13.4	6.4	14.3	19.4
L SNAKE RIVER, N. FORK	85	13	33	8480	90/08/09	**CRC**	500	45.0	5.4	16.9	21.8
L SNAKE RIVER, N. FORK	85	13	27	8600	90/08/09	**CRC**	524	36.7	5.1	19.2	24.0
L SNAKE RIVER, N. FORK	85	13	26	8910	90/08/16	**CRC**	330	23.1	5.5	14.7	19.7
L SNAKE RIVER, N. FORK	85	13	26	8960	92/07/28	**CRC**	470	28.2	4.0	9.9	15.2
LITTLE MUDDY CREEK	88	17	6	7980	91/07/23	BKT	698	83.8	8.0	3.4	8.9
LITTLEFIELD CREEK	89	17	10	7590	91/09/10	BKT	137	19.2	7.2	0.3	6.0
LITTLEFIELD CREEK	89	17	13	7850	91/07/23	BKT	407	57.0	6.8	0.6	6.3
MCKINNEY CREEK	88	18	31	7869	86/07/29	BKT	379	33.0	5.3		
MILL CR, R. BRANCH	87	14	14	8520	83/09/02	**CRC**	211	8.0	4.2		
MILL CREEK	87	14	14	8700	90/07/18	**CRC**	26	1.3	5.1	7.0	12.4
MILL CREEK, S. FORK	87	14	27	8200	87/08/05	**CRC**	78	10.9	6.7	3.4	8.9
MUDDY CREEK	89	17	32	7320	91/07/24	BKT	0	0.0	0.0	1.4	7.0
MUDDY CREEK	89	16	3	7495	91/07/24	BKT	0	0.0	0.0	4.0	9.5
RABBIT CREEK	86	13	25	9030	90/07/25	**CRC**	18	0.9	4.9	6.1	11.5
ROARING FORK	86	12	16	7040	84/09/19	BKT	349	28.0	5.0	27.2	31.7
ROARING FORK	86	13	13	10080	92/07/29	**CRC**	978	58.7	5.2	12.6	17.7
ROSE CREEK	85	12	17	7890	90/08/08	**CRC**	905	45.3	3.5	8.3	13.6

Table 2. (cond't)

	STATION LOCATION						NUMBER	POUNDS	LENGTH	HQI	HABITAT
STREAM NAME	R	T	S	ELEVATION	DATE	SPECIES	PER MILE	PER/MILE	INCHES	SCORE	UNITS
SKULL CREEK	87	14	16	8100	85/08/14	**CRC**	444	47.0	6.0		
SKULL CREEK	87	14	16	8100	85/08/14	BKT	778	113.0	7.0		
SOLOMAN CREEK	85	12	7	8040	90/07/26	**CRC**	1020	51.0	4.6	9.9	15.2
SOLOMAN CREEK	85	12	5	8440	90/07/26	**CRC**	637	51.0	4.9	42.5	46.3
SOLOMAN CREEK	86	13	32	8760	92/07/30	**CRC**	184	16.6	5.7	6.4	11.8
SOLOMAN CREEK	86	13	32	8840	92/07/30	**CRC**	196	17.6	5.9	17.9	22.8
STANDARD CREEK	86	13	24	9200	90/07/24	**CRC**	221	26.5	6.8	12.1	17.3
TED CREEK	85	13	22	9150	92/08/05	**CRC**	129	11.6	5.4	20.2	25.0
TED CREEK	85	13	22	9220	92/08/05	**CRC**	384	38.4	3.9	9.8	15.1
THIRD CREEK	85	13	27	8880	90/07/25	**CRC**	176	7.0	4.2	7.3	12.7
THIRD CREEK	85	13	27	8940	90/07/25	**CRC**	723	28.9	4.4	7.3	12.7
WEST BRANCH (NFLSR)	86	13	25	9070	90/07/24	**CRC**	626	50.1	2.7	9.9	15.2
WEST BRANCH (NFLSR)	86	13	24	9094	90/07/24	**CRC**	201	8.0	4.2	10.6	15.8

Spawning is initiated when water temperatures reach approximately 7^0C (Benke and Zarn, 1976). Redds are generally small and are located within gravel substrate in water depths of 0.2 to 1.0 ft. with an average water velocity of 1.0 to 2.1 ft/second (Jesperson, 1981; Quinlan 1980). Jesperson (1981) documented spawning in intermittent streams that were unsuitable adult habitat. In small headwater streams, sexually mature fish may be only 5-8 inches in length and spawn only 100-200 eggs. Stream populations generally reach sexual maturity between 2 and 4 years of age (Binns 1977).

Size

Historically, *O. c. pleuriticus* were believed to have reached large sizes in the Colorado River basin and purportedly reached a size of 20 pounds or more. Today, the remaining populations of *O. c. pleuriticus* are located in small headwater streams and seldom reach a size over 12 inches. Larger fish have been taken from lake populations in Colorado, but no lake populations of *O. c. pleuriticus* currently exist within the Little Snake River Enclave (Behnke 1992).

BIOTIC INTERACTIONS

Competition

Competition between non-native trout and *O. c. pleuriticus* is believed to occur but has not been scientifically demonstrated (Griffith 1988). Where conditions are favorable, *S. fontinalis* tend to saturate their environment. Thus, past stocking efforts, where brook trout were stocked into small streams, are believed to have resulted in large numbers of *S. fontinalis* directly competing with the indigenous *O. c. pleuriticus* for limited food and space (Griffith 1988; Fausch 1989). For example, non-native salmonids have been extensively stocked in the Little Snake River system and is believed to be the major cause for the sharp decline of *O. c. pleuriticus* within the Enclave (Table 3).

Data, compiled from Wyoming Game and Fish survey reports, Medicine Bow National Forest survey reports, and personal observation from biologists involved in *O. c. pleuriticus* management within the enclave over the past 20 years, illustrate the dramatic effect stocking of *S. fontinalis* has had on *O. c. pleuriticus* distribution. In the 1950's, approximately 73 miles of streams contained allopatric populations of *O. c. pleuriticus* in 32 streams (2nd order and larger) in the enclave. By 1992, the total miles with allopatric populations dropped to approximately 51 miles in 27 streams. This represents a 30 percent reduction in stream miles over 40 years.

Table 3. Summary of historical planting records for the Little Snake River Drainage (Modified from Oberholtzer 1990). Abbreviations are as follows: BKT-brook trout, CUT-cutthroat, RBT-rainbow trout.

WATER	SPECIES	YEAR STOCKED
Savery Creek	BKT	1936,37,42,46,49,52.
	CUT	1933,37,42,44,45,46,' 48,49,50, 53
Big Sandstone Creek	CUT	1936,37,42,43,49,50,51.
	BKT	1953
	RBT	1959 1977
Little Sandstone Creek	CUT	1937,49,53,56,58.
	BKT	1959
	BRN	1936
Little Savery Cr.	CUT	1942,48,49,52,56.
N. Fk. Savery Cr.	BKT	1937,42,52,55,56 and 57-60.
	CUT	1937,48,51,56.
Fish Creek	CUT	1948,56.
E. Fk. Savery Cr.	CUT	1953
Dirtyman Cr.	CUT	1942,46,48,49,53.
	BKT	1955,56,59,60,70,71
	RBT	1969
Battle Creek	CUT	1936,37,42,43,45,51,53,56.
	RBT	Annual since 1957
Battle Lake	CUT	1954
Haggerty Creek	CUT	1946

Table 3. (cond't)

WATER	SPECIES	YEAR STOCKED
Lost Creek	CUT	1942,43,46, 50.
Haskins Cr.	CUT	1942,43,49,50.
Roaring Fork	CUT BKT	1936,37,50. 1941
North Fork of Little Snake River	CUT	1936,45,50,52.
W. Branch North Fork of Little Snake River	CUT	1936,50,52
Harrison Cr.	BKT	1936

Sympatric populations (*S. fontinalis* and *O. c. pleuriticus*) were in 6 miles of stream in the 1950's, increased to a peak of 27 miles in the 1980's, and then declined to approximately 17 miles by 1992. Reduction in miles of stream containing sympatric populations is largely due to the extirpation of cutthroat in the headwaters of the Big Sandstone drainage as streams converted from *S. fontinalis/O. c. pleuriticus* fisheries to *S. fontinalis* fisheries and the construction of fish barriers prohibited further *S. fontinalis* invasion into allopatric populations of *O. c. pleuriticus*.

Parasites

Gyrodactylis elegans, a monogenetic fluke, has been discovered to affect *O. c. pleuriticus* within the North Fork of the Little Snake River. This fluke inhabits the gill region of fish and, in extreme cases, has been known to result in fish mortality in both lake and hatchery settings in Wyoming (Doug Mitchum, pers. comm.). Infection by *G. elegans* in the North Fork fish does not appear to be a significant problem at the present time.

Hybridization with Other Salmonid Species

The extensive stocking of non-native salmonids has led to hybridization of *O. c. pleuriticus* stocks in the enclave. Such hybridization is the primary cause of the loss of pure forms of native trout in the western states (Behnke 1992). Forty-four percent of the streams containing *O. c. pleuriticus* on the forest show some level of hybridization with other salmonids. Hybridization is believed to have occurred with both Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) and rainbow trout (*Oncorhynchus mykiss*).

MANAGEMENT INTERACTIONS

Some of the current *O. c. pleuriticus* habitat has been altered by man's activities. These impacts fall within four primary groups: livestock grazing, logging (and associated road construction), water diversions, and mining. Within the Little Snake River enclave, livestock grazing, timber harvest activities, and water diversion are believed to have had the greatest effect on *O. c. pleuriticus* habitat and populations. Fire suppression has also affected cutthroat by allowing vegetation in riparian areas to advance towards late or climax succession thus decreasing the abundance and diversity of aspen in many areas. The decrease in aspen has lead to decreased numbers and distribution of beaver dams which provide important pool habitat for *O. c. pleuriticus*.

The purpose of this section of the management plan is to provide an overview of the current status of *O. c. pleuriticus* habitat in the enclave and to identify land management activities which have influenced these habitats.

Livestock Grazing

Within the Medicine Bow National Forest, site-specific impacts to stream habitats occur due to livestock grazing. In such instances, streambank vegetation is trampled and bank erosion potential increases. While these areas reduce habitat quality on a site-specific basis, poor riparian condition does not appear to be a major factor limiting *O. c. pleuriticus* populations on the Forest. Those areas that have been affected by livestock grazing demonstrate remarkable ability to recovery if managed properly. One such example is Mill Creek on the Medicine Bow National Forest. Wyoming Game and Fish Department Habitat Quality Index (HQI) data, collected in the 1980's, indicated approximately 20 percent of low gradient reaches of Mill Creek were actively eroding from livestock-caused bank trampling. During the Allotment Management Plan (AMP) revision, the District decided to rest the area from any livestock use. In 1991, bank condition data were again collected along low gradient reaches by Forest Service crews. Less than 2 percent of the reaches were considered to be actively eroding and good willow regeneration was documented. The Medicine Bow National Forest continues to identify and revise AMP's to bring riparian areas into compliance with Forest Plan standards and guidelines.

For streams in the Muddy Creek drainage, past livestock use and the practice of spraying willows with herbicides (on BLM, state, and private lands) have left the streams in degraded conditions. Typically many of the streams are incised and actively eroding. As a result, stream temperatures are generally high with little suitable habitat to support *O. c. pleuriticus*. Beaver were an important component of the aquatic ecosystem historically, but have been greatly reduced due to loss of aspen and willow in the area.

Since 1990, livestock grazing has improved dramatically with the development of three new revised allotment plans which stress improved riparian management within the Muddy Creek drainage. The objectives of these plans identified the need to improve density and height of willow, increased residual cover following livestock grazing of herbaceous species for bank cover, and reduction of bank trampling damage by livestock. Monitoring efforts during the summer of 1993 indicate substantial improvement in riparian area condition.

In 1993, a Coordinated Resource Management Plan (CRMP) committee was formed to enable affected agencies, private landowners, and interested parties to improve riparian grazing management and transportation management in the entire upper Muddy Creek watershed. The plan is not expected to be implemented until late 1994.

Water Diversions

The most recent factor affecting *O. c. pleuriticus* in the Little Snake River drainage is loss of habitat due to water diversion. In 1961, a three-stage water supply plan was developed for the City of Cheyenne to meet projected future water needs. Stage I was completed by 1964 and operational by 1967. Ten water diversion structures were installed in three streams in the North Fork drainage as part of the collection system for Stage I. These structures are located above 8,800 feet elevation and are connected by a gravity flow pipeline which transports water to a tunnel under the Continental Divide. Water passing through the tunnel flows into Hog Park Reservoir which serves as storage for controlled release water into the North Platte system.

Construction of Stage II was initiated in 1982 and included the enlargement of the gravity flow collection system in the North Fork drainage. A twenty-five mile collector system was constructed and subsequently, water was diverted from every stream containing *O. c. pleuriticus* in the North Fork drainage. Several intensive studies ensued to assess the potential impact of the project. The studies provided recommendations for maintenance and flushing flows (Jesperson 1979, 1980 and Wesche et al. 1977). These recommendations were implemented on the project. Stage III involves the construction of a large reservoir off the Medicine Bow National Forest on Big Sandstone Creek. Stage III is currently under study by the State Engineers Office.

As a result of construction of the Stage II pipeline, several water quality violations occurred in the North Fork drainage between 1983 and 1993 (Hipple 1986, Schmal 1986, Wilcox 1989). Sediment input into channels was greater than natural undisturbed sediment levels and is believed to be exceeding stream transport capabilities. The largest of these events was in 1988 when approximately 2000 cubic yards of sediment were discharged down Henry Creek directly into Green Timber Creek impacting approximately 3/4 mile of stream. These impacts were mitigated in 1989 with the installation of 35 structures. The structures were designed to stabilize some of the sediment in areas adjacent to the channel, to create pools, and to aid in the development of new channels. Many of these structures incurred substantial damage in the spring of 1990. In the spring of 1992 and again in 1993, other sediment spills occurred at the point where the Stage I pipeline crosses Green Timber Creek. Approximately 500 yards of *O. c. pleuriticus* habitat were directly affected by these sediment spills. Monitoring conducted by Wyoming Game and Fish and Forest Service biologists in 1988, 1989 and 1992 demonstrated that trout standing stocks have been impacted. Studies conducted by the Forest Hydrologist on the Medicine Bow

National Forest indicate a recovery time of at least 20 years before sediment is transported from Green Timber Creek into the North Fork of the Little Snake. The Forest Service and Wyoming Game and Fish Department continue to monitor the situation in Green Timber Creek.

The collection structures on both Stage I and II pipelines are blocking movement of fish into the upper areas of affected streams or are allowing fish to leave the system through the pipeline. Deadman Creek, the West Branch, Rabbit Creek, Standard Creek, and Third Creek all experienced declines in population numbers from 1986 at stations located upstream from the pipeline (Oberholtzer 1990). Jespersen (1981) indicated that headwater areas in the North Fork provided some of the best spawning habitat and the highest fry survival rates in the drainage. He further documented that young fish surviving in the upper reaches move downstream as they increase in size and require habitat with greater depth, thus providing recruitment to downstream areas. Stage I and II collection structures may also be greatly reducing numbers of fish emigrating downstream. This, in turn, affects the population levels in the main body of streams influenced by the diversions.

While flow requirements have been established on some streams containing *O. c. pleuriticus* (i.e. Stage I and II streams), additional streams may need to be examined. Under Wyoming's Instream Flow Law, the State can file on available flow to maintain or improve an existing fishery. Many of these diversions on Forest Service and BLM lands are under special use permits. These permits are periodically reviewed and, if needed, changed to rectify conditions that are not currently in compliance with land management standards and guidelines.

Logging and Road Construction:

Timber harvest activities have been shown to increase streamflow in small watersheds, with the degree of increase dependent upon the amount of harvest, average annual precipitation, and physical characteristics of the watershed (Troendle 1980, Troendle and King 1987). Should flood peaks be augmented from the removal of vegetation within a watershed, channel adjustments may occur in terms of channel width, depth, cross sectional area, and slope to accommodate the additional flow. Generally, while the duration of flood peak flows increases, the magnitude of the peak flows are not significantly changed (Leaf 1970, Alexander et al. 1985).

A recent study completed on the Medicine Bow National Forest indicates that maximum pool depth, large woody debris, and the abundance of pools greater than 30 cm deep, were less in logged drainages than in unlogged (Eaglin 1991). These habitats can be important as over-wintering habitat, cover, and refuge areas during late summer low flow periods. Mechanisms to describe these changes in habitat are currently unknown.

Roads, particularly those with stream crossings, can also negatively affect instream habitats depending upon how culverts are placed and the types of mitigation implemented. Roads can affect streams directly by accelerating erosion and sediment loading into stream channels, by altering stream channel morphology, and by changing the runoff characteristics of the watershed. Eaglin (1991) documented that culvert density and stream size significantly account for variation in stream substrate features and trout standing stock on the Medicine Bow National Forest. As the number of culverts per square kilometer of watershed area increased, the amount of sediment deposition increased, resulting in degraded trout habitat. Sediment from roads, both in the Littlefield drainage on BLM land and within *O. c. pleuriticus* drainages on the Medicine Bow, continues to affect stream habitat conditions to various degrees.

Mining:

The affect of mining on *O. c. pleuriticus* populations or habitat has not been widespread within the Little Snake drainage. Small "glory holes" are located throughout many of the watersheds but are not a significant source of point or non-point pollution. The only exception to this broad generality is the Ferris-Haggarty copper mine located in the headwaters of Haggarty Creek on the Medicine Bow National Forest.

The Ferris-Haggarty copper mine was last actively mined in 1903 then abandoned. Natural springs flowing through the mine shaft absorb high concentrations of copper and flow into Haggarty Creek, making four to five miles of the stream biologically sterile. This stream historically contained *O. c. pleuriticus* as evidenced by the presence of the fish in tributaries to Haggarty Creek. In 1992, the State obtained a judgement against the current mine owner which has resulted in the hiring of a consultant to investigate possible measures to eliminate or reduce the copper effluent. In the fall of 1993, a proposed treatment was submitted to the State's Abandoned Mine Lands (AML) Division for their consideration and approval. As of April 1994, no decisions have been made on this issue.

SUSCEPTIBILITY TO ANGLING

O. c. pleuriticus are easily caught by anglers. Their high susceptibility to angling limits the population size and rates of recovery in streams that are accessible to the public. Special regulations such as catch and release, flies and lures only, etc. will be required to prevent overexploitation.

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